REMARKS/ARGUMENTS

Reconsideration of the application is requested.

Claims 1-35 remain in the application. Claims 1-7, 11-13, 15, 17, and 19-23 are subject to examination and claims 8-10, 14, 16, 18, and 25-35 have been withdrawn from examination.

In the second paragraph under "Claim Rejections - 35 USC § 103" on page 2 of the above-identified Office Action, claims 1-3, 7, 11-13, 15, and 17 have been rejected as being unpatentable over Kawakubo et al. (U.S. 5,952,687) (hereinafter "Kawakubo") in view of Azuma et al. (U.S. 5,708,302) (hereinafter "Azuma") under 35 U.S.C. § 103(a).

As will be explained below, it is believed that the claims were patentable over the cited art in their original form and, therefore, the claims have not been amended to overcome the references.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful. Claim 1 calls for, *inter alia*, a method of producing a structured layer, which has the following steps:

applying to the prestructured substrate a precious metal and a donor material containing an additive which is not a precious metal in two or more layers;

subjecting the layers to heat treatment at a temperature of between approximately 400°C and approximately 800°C, such that the additive diffuses into the precious metal and an alloy layer is produced; and

polishing the alloy layer by chemical and mechanical means. (emphasis added)

Kawakubo discloses (in Figs. 4A-4E) a method of manufacturing a memory cell with a switching transistor and a storage capacitor. Fig. 4B shows a prestructured substrate 1 with switching transistor 3, 4, 6a, 6b, a bit line 8, a contact plug 11, an insulating layer 9, and a polishing-stop layer 10. A barrier metal film 12 made of titanium nitride is formed partly on the polishing stop layer 10 and partly on the inner surface of the trench (Fig. 4C). The bottom electrode 13 made of iridium is formed on the barrier metal film 12. Further, on the bottom electrode 13 a flattening insulating layer 16 made of boronsilicate glass (BSG) is formed. The barrier film

12 can be made of titanium, tantalum, tantalum nitride or the like. Thereafter, as shown in Fig. 4D, those portions of the barrier metal film 12, bottom electrode 13 and insulating layer 16, which were deposited on or above the polishing stop layer 10, are removed by mechanical polishing. Mechanical polishing is used since the barrier metal film 12 and the bottom electrode 13 are very thin, 100 nm or less. See column 7, lines 48-66.

As stated by the Examiner, Kawabuko is deficient in that it does not disclose or teach "that the bottom electrode is formed by applying a precious metal and a donor material and subjecting the layers to a heat treatment." Nor does Kawabuko disclose an additive contained in the donor material, or even mention heat treatment as recited in the claims.

Azuma discloses a method for manufacturing a dielectric or ferroelectric integrated circuit capacitor with the emphasis on manufacturing a bottom electrode that adheres well and does not have short-inducing surface irregularities due to the diffusion or blooming of silicon. Fig. 1 shows a capacitor 20 including substrate 22, bottom electrode 24, metal oxide layer 26, and top electrode 28. Bottom electrode 24 includes a

plurality of respective layers including adhesion metal portion 34, first noble metal portion 36, diffusion barrier region 38, and second noble metal layer 40. Adhesion metal portion 34 is preferably made of Ti or Ta, first noble metal portion 36 is preferably made of Pt, but may also be Au, Ag, Pd, Ir, Rh, Ru, Os or conductive oxides of these metals. After deposition, portions 34 and 36 are preferably annealed to promote their interdiffusion, thereby providing barrier region 38. Region 38 is defined as the material between lower dashed line 42 and upper dashed line 44. Interface 50 is positioned between adhesion metal portion 34 and first noble metal portion 36, and represents the interlayer boundary at a time prior to the diffusion that forms barrier region 38 (see column 4, line 55 to column 5, line 20). The interdiffusion of portions 34 and 36 serves to increase the stability of the lattice, which correspondingly enhances resistance against diffusion through or from region 38 (see column 5, lines 38-41).

Applicants submit that claim 1 is not obvious over Kawakubo in view of Azuma.

The Examiner acknowledges that claim 1 differs from Kawakubo

at least by the step of "subjecting the layers to a heat treatment." Applicants submit that this feature is novel and not obvious over Kawakubo in view of Azuma.

According to the present invention, layers made of precious metal are difficult to structure by a chemical-mechanical polishing (CMP) because of the chemical inertness of the material (see page 5, lines 9-25 of the instant specification).

The present invention solves this problem by introducing an additional donor material and heat treatment that allows for a "conventional CMP, in particular with the aid of conventional slurries, such as already used for structuring non-precious metals" (see page 7, lines 9-13 of the instant specification).

Kawakubo suggests the problem encountered during structuring precious metal bottom electrode layer 13 (see Figs. 14C-D) by disclosing that "[m]echanical polishing was used since the barrier metal film 12 and the bottom electrode 13 were very thin 100 nm or less ..." and "...could be removed by chemical mechanical polishing which scarcely damages the objects being published" (see col. 7, line 64 to col. 8, line 3) (underlining added). Thus, Kawakubo discloses that mechanical

and/or chemical polishing of precious layers can be carried out only for very thin layers and with the risk of at least some damage to the objects being polished.

Therefore, a person skilled in the art who wants to structure a precious layer by a CMP step, starting out with the disclosure of Kawakubo, would logically look for methods that can polish precious layers without being limited to layers that have to be "very thin" or have "some damage" afterwards. Azuma does not address this problem and, therefore, would not have been considered for providing a solution to the problem disclosed by Kawakubo. Nor has the Examiner even shown any reason to modify Kawakubo in the first instance.

Accordingly, applicants respectfully submit that a person skilled in the art would not have been motivated to combine Kawakubo with Azuma to arrive at the claimed invention. Therefore, the heating step of claim 1, namely, "subjecting the layers to heat treatment at a temperature of between approximately 400°C and approximately 800°C, such that the additive diffuses into the precious metal and an alloy layer is produced" is not obvious over Kawakubo in view of Azuma.

The Examiner also contends that "it would have been obvious...

to modify the method disclosed by Kawakubo et al. by forming the bottom electrode using the method taught by Azuma et al because a person of ordinary skill...would have been motivated...to form a bottom electrode that adheres well to the underlying layers and does not have short-inducing surface irregularities."

Applicants submit that this statement is incorrect and without proper basis at least for the following reasons. Kawakubo does not disclose any problem relating to adherence of the bottom electrode to the underlying layers.

Moreover, Kawakubo already provides good adherence of the precious layer 13 to the underlying layers 11, 9 by barrier layer 12 between the two layers (see Fig. 4C-4D). Barrier layer 13 is made of "titanium, tantalum, tantalum nitride or the like" (column 7, lines 55-57), which are known to provide good adherence of precious metal layers to underlying layers (e.g., see Azuma column 1, lines 33-36).

Therefore, contrary to the Examiner's statement, a person skilled in the art would not have had any motivation or reason to combine the disclosure of Azuma with Kawakubo as proposed by the Examiner. One skilled in the art would refrain from

any unnecessary heat treatments, since it is well known in the semiconductor processing industry that it is important to minimize heating to reduce any possible damage to semiconductor devices. Thus, one skilled in the art would not go out of his or her way to do something that is contrary to good practice and inconsistent with established practices in the art to which the invention pertains.

Therefore, it is clearly apparent that a person skilled in the art would not combine Kawakubo with Azuma as proposed by the Examiner.

Azuma does not overcome the deficiencies of Kawakubo and for reasons discussed above a person skilled in the art would not combine Kawakubo and Azuma to obtain an improvement for a chemical mechanical polishing of a precious metal layer as recited in claim 1. The Examiner has not shown any teaching or basis in the primary reference of Kawakubo that would warrant or justify the proposed modification of Kawakubo by Azuma as proposed by the Examiner. The Examiner has merely stated that it would have been obvious to modify Kawakubo by Azuma "because a person of ordinary skill in the art...would have been motivated to use the method taught by Azuma...in order to form a bottom electrode that adheres well to the underlying

layers and does not have short-inducing irregularities…." However, while Azuma discloses that the substrate is heated in a diffusion furnace, the Examiner has not shown why Kawakubo would even want or need to be modified. One skilled in the art would not seek out a secondary reference unless there was a reason in the primary reference that justified or required modification. In this instance, it is submitted that the Examiner has not shown any reason to modify Kawabuko as proposed, and that the motivation suggested by the Examiner is in the secondary reference of Azuma and therefore, is insufficient reason to support modification of Kawabuko and the proposed combination of references.

Clearly, Kawakubo and Azuma do not show "applying to the prestructured substrate a precious metal and a donor material containing an additive which is not a precious metal in two or more layers; subjecting the layers to heat treatment at a temperature of between approximately 400°C and approximately 800°C, such that the additive diffuses into the precious metal and an alloy layer is produced; and polishing the alloy layer by chemical and mechanical means", as recited in claim 1 of the instant application. (emphasis added)

In the first full paragraph on page 4 under "Claim Rejections - 35 USC § 103" of the above-identified Office Action, claims 19-21 and 23 have been rejected as being unpatentable over Kawakubo in view of Azuma and further in view of Russell et al. (U.S. 6,395,194) (hereinafter "Russell") under 35 U.S.C. § 103(a).

The foregoing discussion of Kawakubo and Azuma applies equally in the rejection of claims 19-21 and 23, which depend directly or indirectly on independent claim 1. Russell does not overcome the basic deficiencies of Kawakubo and Azuma, and certainly does not lend any credence to the proposed combination of these references. Therefore, the claims are believed patentable over the cited prior art for the reasons previously advanced.

In the first full paragraph on page 5 under "Claim Rejections - 35 USC § 103" of the above-identified Office Action, claims 19, 20, and 22 have been rejected as being unpatentable over Kawakubo in view of Azuma and further in view of Kirlin et al. (U.S. 5,976,928) (hereinafter "Kirlin") under 35 U.S.C. § 103(a).

The above discussions of Kawakubo and Azuma are applicable in the instant rejection of claims 19, 20, and 22, which depend directly or indirectly on independent claim 1.

Kirlin does not make up for the deficiencies of Kawakubo and Azuma, individually or in the combination of these references. Therefore, claims 19, 20, and 22 are believed patentable over the prior art for the same reasons as previously advanced.

It is accordingly believed to be clear that none of the references, whether taken alone or in any combination, either show or suggest the features of claim 1. Claim 1 is, therefore, believed to be patentable over the art. The dependent claims are believed to be patentable as well because they all are ultimately dependent on claim 1.

Finally, applicants appreciatively acknowledge the Examiner's statement that claims 4-6 and 24 "would be allowable if rewritten in independent form including all of the limitations

of the base claim and any intervening claims." In light of the above, applicants respectfully believe that rewriting of claims 4-6 and 24 is unnecessary at this time.

In view of the foregoing, reconsideration and allowance of claims 1-35 are solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate receiving a telephone call so that, if possible, patentable language can be worked out. In the alternative, the entry of the amendment is requested, as it is believed to place the application in better condition for appeal, without requiring extension of the field of search.

If an extension of time for this paper is required, petition for extension is herewith made.

Appl. No. 09/734,467
Amdt. Dated November 6, 2003
Reply to Office Action of August 7, 2003

Please charge any other fees that might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner and Greenberg, P.A., No. 12-1099.

Respectfully submitted,

LAURENCE A. GREENBERG
REG. NO. 29,308

For Applicants

FDP/tk

November 6, 2003

Lerner and Greenberg, P.A.
Post Office Box 2480
Hollywood, FL 33022-2480
Tel: (954) 925-1100
Fax: (954) 925-1101